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NEW BRUNSWICK

PLANTATION CLEANING TRIALS

1981, 1982, 1983

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NEW BRUNSWICK

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ABSTRACT

The objective of plantation cleaning is to enhance survival and growth of planted trees by reducing competition from other vegetation. Plantation cleaning using manual and motor-manual methods has been tested in New Brunswick since 1981. The trials were divided into three categories:

(1) Operational cleaning where the objective was to release trees rather than test the methods
(2) Cleaning trials where the objective was to compare the producitivity and effectiveness of various methods, and
(3) Cleaning tenders where tenders were awarded for manual plantation cleaning.

The results of manual cleaning to date indicate inconsistent responses of the planted trees and rapid regrowth of other vegetation after cleaning. Manual cleaning is expensive with costs of at least $500 per hectare for plantations with severe competition problems.

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INTRODUCTION

The New Brunswick Department of Natural Resources has been using herbicides (2,4-D and 2,4,5-T) to enhance survival and growth of planted trees by reducing competition from other vegetation in young plantations (less than 5-years old) since the late 1970s. Use of these herbicides in New Brunswick has been restricted within 3.2km of human habitation and their general use has been controversial. This is a report on trials in 1981, 1982 and 1983 using manual and motor-manual equipment to cut undesirable vegetation in an attempt to find alternatives to chemical control.

The trials were of 3 categories: (1) Operational Cleaning where the objective was to release trees rather than test the methods. (2) Cleaning Trials where the objective was to compare productivity and effectiveness of various methods and (3) Cleaning Tenders where tenders were awarded for plantation cleaning. A brief description of each project follows.

1. OPERATIONAL CLEANING

Edmundston

In 1981, 22 hectares of plantation were cleaned manually using hatchets or brush axes and 20 hectares were cleaned motor-manually using brush saws. Damage to planted trees was similar (<2%) with each method.

The entire area between planted trees was cleared in contrast to a radius around the trees. By 1982, considerable regrowth had occurred and one of the areas was recleaned manually. The 1981 density, stocking and height information on the plantations are not available; however, Table 1 gives detailed information on the condition of two of the plantations in early spring 1983. At Gounamitz River, planted trees were taller in the cleaned area but there was no significant difference in stocking or density between cleaned and control areas. At Lunts Brook there was no significant difference in stocking, density or height of planted trees between cleaned and uncleaned areas. Sampling, however, may have been inadequate since the numbers suggest that cleaned areas may have higher stocking and density than uncleaned areas. The 1982 cleaning occurred late in the summer, so its effect on planted trees did not show up in early spring 1983.

Table 1. Results of May 1983 measurements in plantations cleaned by Region 5.

Plantation	Planted Trees			Woody Stems		Raspberry Stems	
	Stocking[1]	Density[2]	Height[3]	Density[2]	Height[3]	Density[2]	Height[4]
Gounamitz							
Cleaned 1981	57	1350	34	13 400	90	73 600	70
Control	51	1400	25	35 200	260	109 000	105
Lunts							
Cleaned 1981	70	2520	43	18 300	95	130 000	90
Control	52	1680	39	15 700	160	330 00	130
Cleaned 1981&1982	68	2500	41	43 570*	80*	383 00*	83*

1 - % stocking based on 5 m^2 plots
2 - stems per hectare
3 - average height of the tallest individual in each plot in centimetres
4 - average of the average height of raspberry in each plot in centimetres
* - measured at time of 1982 cleaning

Canterbury

In 1982, 54 hectares of a one year old spruce plantation at Brown's Mountain were cleaned. Loping shears and a whipper snipper were used to clean a 60cm radius around planted trees. Data on density of the vegetation, quality of the work or effect on the planted trees were not recorded.

2. CLEANING TRIALS

In the fall of 1982 a trial was initiated to compare various motor-manual methods of cleaning plantations. Brush saws and whipper snippers were used to clear an area 60-90 cm in radius around planted trees. Tests were conducted on two sites near Canterbury and one near McGivney with a total of 9 hectares being treated. Vegetation surveys prior to treatment showed 24 000 stems per hectare of woody vegetation with an average height of 130 cm and 140 000 stems per hectare of raspberry with an average height of 80 cm. Cost of treating plantations by these methods were estimated using production rates obtained in the trial and an estimated cost per man-day. This resulted in cleaning costs of $125 per hectare for brush saws and $228 per hectare for whippers. A DNR internal report "Plantation Tending Trials October 1982" has more details on this trial. In the fall of 1983, in two of the three areas the planted trees in the control area (uncleaned) had significantly (95% confidence) more height growth than in cleaned areas (Table 2). There was no control area available for the third site. Regrowth of

raspberries and sprouting of woody stems was noted in the cleaned areas one year after treatment. These areas will be monitored to determine the amount of regrowth.

Table 2 - Heights and leader lengths of planted spruce trees one year after being cleaned.

Location	Height (cm)	Leader Length (cm)
Anderson Road near McGiney (White Spruce)		
Cleaned	60	14
Control	60	17
Brown's Mountain near Canterbury (Black Spruce)		
Cleaned	28	7
Control	31	10
Dinnen Woods near Canterbury (Black Spruce)		
Cleaned	17	
Control	no control area available	

In 1983 the trial was expanded. A plastic flail* was added to the machines being tested and cleaning the entire area between planted trees, not just a radius around them was included in the methods. Tests were conducted in mid-summer when vegetation was green and in late fall after leaves had fallen. The four plantations chosen for these trials had dense growth of raspberries and woody stems that were taller than the planted trees (Table 3). A survey of the cleaned areas will be made in the fall of 1984 to determine the effects of the cleaning.

* similar to a whipper snipper but with solid plastic fingers instead of monofilment cord. The fingers are hinged where they attach to the head.

Table 3. Summary of pre-cleaning vegetation surveys for areas cleaned during 1983 cleaning trials.

	Planted Trees		Woody Stems		Raspberry-Herbaceous	
	Density[1]	Height[2]	Density	Height	Density	Height
Bigqar Brook						
Summer	1670	80	14 300	160	230 000	80
Fall	2080	90	19 200	190	83 800	80
Lunts Brook						
Summer	1360	50	12 900	100	377 000	100
Fall	1740	50	13 100	90	376 00	90
Brown Road						
Summer	1490	40	12 300	90	320 000	100
Fall	1820	40	18 900	140	289 000	130
Marrtown						
Summer	1660	20	22 500	140	176 000	110
Fall	1680	10	18 900	120	141 000	90

[1] stems per hectare
[2] average height in centimetres of the tallest individual in each 5 m^2 plot

During the 1983 trials, production rates were determined. Between 16 and 67 hours were required to clean a hectare (Table 4). It was 36% faster to clean only a radius around each tree and 29% faster to work after leaf fall. Brush saws were the fastest machines and were most suitable because they could cut all stems whereas the other machines could not cut larger woody stems. Costs per hectare were estimated based on the costs per man-day determined for the 1982 trials with an 8% increase for inflation. Calculated costs for an operational program ranged from $520 to $1506 per hectare (Table 5).

Table 4. Hours required to clean a hectare during the 1983 cleaning trials

	Brush Saws		Whipper Snipper		Plastic Flail	
	Complete	Radius	Complete	Radius	Complete	Radius
Bigger Brook						
Summer	34	39	53	44	46	49
Fall	29	19	33	28	--	--
Lunts Brook						
Summer	67	31	56	--	47	41
Fall	45	--	51	24	35	34
Brown Road						
Summer	53	35	61	29	51	35
Fall	36	23	51	23	38	21
Marrtown						
Summer	37	19	62	23	47	25
Fall	24	16	34	22	33	24
Average						
Summer	47.8	31.0	58.0	32.0	47.8	37.5
Fall	33.5	19.3	42.2	24.2	35.3	26.3

Table 5. Cost comparisons of plantation cleaning projects.

Area	Cost ($) Per Hectare	
	Summer	Fall
Cleaning Trials 1982		
Radius Cleaning[1]		
Spacing Saw		125.61
Whipper Snipper		227.90
CleaningTrials 1983		
Complete Cleaning		
Spacing Saw	1 240.26	870.00
Whipper Snipper[2]	1 506.49	1 097.23
Plastic Flail[2]	1 240.26	917.61
Radius Cleaning		
Spacing Saw	805.20	520.09
Whipper Snipper[2]	831.17	629.77
Plastic Flail[2]	974.02	683.88
Cleaning Tenders		
Radius Cleaning		
Lunts Brook		840.16
Pleasant Road		840.16
Pointe Wolfe Road		914.29
Caribou Brook		852.51

1 Cleaning an area 60-90 cm in radius around each tree.
2 Costs include removing larger woody stems with a saw.

3. CLEANING TENDERS

In the fall of 1983, tenders were awarded for cleaning four 20 hectare plantations to determine the cost (on a competitive basis) of manual cleaning as compared to herbicide use. The plantations were candidates for herbicide treatment but provincial regulations prohibited spraying because of their proximity to human habitation. Table 6 gives results of the vegetation surveys for the areas. Contractors were to cut all vegetation within 60 cm of the planted trees, and between 60 and 90 cm from the planted trees cut all stems between 2 and 7 cm in diameter at stump height. Stump height was to be 6 cm however, stump heights of 12 cm were accepted. There was a penalty of $0.75 for each planted tree that was damaged or missed. The tenders were awarded for $840.16 to $914.29 per hectare (Table 5). Saw operators required an average of 28.8 hours to clean a hectare. A survey of the areas after cleaning revealed 1.5% of the planted trees were damaged during cleaning and 9% were missed.

Table 6. Summary of pre-cleaning vegetation surveys for areas cleaned by tender during 1983.

	Planted Trees			Woody Stems		Raspberry	
	Stocking[1]	Density[2]	Height[3]	Density	Height	Density	Height
Lunts Bk.	64	1644	50	6 610	111	300 000	95
Pleanant Ridge	77	1882	42	19 137	120	225 000	98
Pointe Wolfe R.	70	2298	49	16 000	111	220 000	86
Caribou Bk.	74	2000	59	13 674	205	370 000	115

[1] percent stocking based on 5 m^2 plots
[2] stems per hectare
[3] average height in centimetres of the tallest individual in each 5 m^2 plot

DISCUSSION

The objectives of the manual plantation cleaning trials are to obtain cost estimates to compare with chemical competition control and to determine the effect on survival and growth of planted trees.

In terms of cost, manual or motor-manual cleaning is expensive. The 1982 trials indicated costs could be as low as $125 per hectare. These, however, were small trials in which operators were only timed while they were actually working and the supervisor helped locate trees so costs are not comparible with other results. In areas of severe competition, our trials indicate costs would be at least $500 per hectare. If the operating season is extended to working when vegetation is green the minimum cost is increased to $800 per hectare. The above costs assume it is adequate to clean only a 60-90 cm radius around each tree. If it is necessary to clean the entire area between trees the costs increase 60 percent. It is obvious that any implementation of cleaning programs should be related to the quantity and type of undesirable vegetation and to season of treatment.

Growth information is available for two plantations and in each of them, growth during the first year after cleaning in the control areas was greater than in the cleaned areas. Height one year after cleaning is available for two other plantations and in one case there was no difference in height; and in one case trees in the cleaned area were taller than the control area. Height

differences, however, may not reflect increased growth since we do not know how the heights compared at the time of cleaning. Stocking and density information is available for two plantations but at the given level of sampling there was no significant difference between the cleaned and control areas. These results are not unexpected. Young seedlings growing under heavy competition often do not have an adequate root system to supply the extra moisture required when they are exposed to direct sunlight. Also, trees growing in the shade have shade foliage that performs best under shade conditions and trees growing in direct sunlight have sun foliage that performs best in sunny conditions. The type of foliage is determined by the light conditions the trees were exposed to the previous fall, so in the year of cleaning seedlings in cleaned areas would have shade foliage that could not take full advantage of the direct sunlight. If the cleaning is done so the seedlings are in direct sunlight during late summer and fall the seedlings would prepare for direct sunlight conditions the next year but with rapid regrowth of other vegetation they will have to grow in shade conditions.

In terms of reducing competition from hardwoods and raspberries cutting them does not eliminate them. One year after cleaning, Lunts Brook Plantation had 43 000 woody stems and 380 000 raspberry stems per hectare with a height of 80 centimetres. This represents an increase in number but reduction in height from the uncleaned area. Measurements are not available for other plantations, although visual checks indicate a similar situation with intensive sprouting of hardwoods and rapid regrowth of

raspberries.

During the trials, hand tools, chain saws, whipper snippers, plastic flails and brush saws have been tested. Brush saws were considered most suitable because they could handle all vegetation and generally had the lowest cost per hectare. Production with hand tools was low, so costs were high. Chain saws required the operator to bend over constantly and did not readily cut flexible stemed vegetation. Whipper snippers and plastic flails could not cut the larger woody stems and were hard to control close to the planted trees.

In light of the high costs and inconclusive results of these manual and motor-manual plantation cleaning trials, future efforts should be to monitor plantations already cleaned. Monitoring should include checking the effect on planted trees of cleaning at different times of year, cleaning only a radius around each tree, and cleaning at different stages in the trees development. There are sufficient trials in place now to allow for this monitoring.